

# **APPENDIX A**

## **GLOSSARY**

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**Active Channel Stage:** The active channel stage or ordinary high water level is an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence on the landscape, such as the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial or the bank elevation at which the cleanly scoured substrate of the stream ends and terrestrial vegetation begins (Figure 3-2).

**Aggradation:** The geologic process by which a streambed is raised in elevation by the deposition of additional material transported from upstream (Opposite of degradation).

**Anadromous Fish:** Fish that migrate from the ocean into freshwater to breed. Includes salmon and steelhead trout, as well as several other species of fish.

**Apron:** A hardened surface (usually concrete or grouted riprap) placed at either the invert of the culvert inlet or outlet to protect structure from scour and storm damage. Aprons often are migration barriers because flow is often shallow with high velocities. Aprons at outlet may also create turbulence and increase stream power that often down cuts the channel, resulting in perched outlets and/or de-stabilized streambanks.

**Armor:** A surface streambed and bank layer of coarse grained sediments that are rarely transported. This layer protects the underlying sediments from erosion and transport, while creating enough roughness to prevent channel down-cutting.

**Backwater:** Stream water, obstructed by some downstream hydraulic control, is slowed or stopped from flowing at its normal, open-channel flow condition.

**Baffles:** Wood, concrete or metal panels mounted in a series on the floor and/or wall of a culvert to increase boundary roughness and thereby reduce the average water velocity and increases flow depth in the culvert.

**Bankfull Stage:** Corresponds to the stage at which channel maintenance is most effective, that is, the discharge at which the stream is moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels. (Figures 3-2).

**Bed Roughness:** The unevenness of streambed material (i.e. gravel, cobbles) that contributes resistance to stream flow. The degree of roughness is commonly expressed using Manning's roughness coefficient (see Equation 2 in Chapter 5, *Hydraulic Design Option*).

**Bedload:** Sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water. The particles of this material have a density or grain size which prevents movement far above or for a long distance out of contact with the streambed under natural flow conditions.

**Breaks-in-slope:** Steeper sections within a culvert. As culverts age they often sag when road fills slump. *FishXing* is able to model changes in velocity created by varying slopes within several culvert sections.

**Cascade:** A series of small, vertical drops within a channel. They can be natural or man-made.

**CFS:** Cubic feet per second.

**Channel-bed width:** For the purpose of culvert design, the channel-bed width is defined as the width of the bankfull channel. The bankfull channel is defined as the stage when water just begins to overflow into the active floodplain. Determining bankfull width requires the presence of a floodplain or a bench; however, many channels have neither. In those cases, bankfull channel must be determined using features that do not depend on a floodplain, such as those used in the description of active channel and ordinary high water (see Chapter 4, *No-Slope Design Option* and Appendix F, *Summary Forms for Fish-Passage Design Data* for more information). Refer to Appendix H, *Measuring Channel-Bed Width* for details and information on how to measure channel-bed width.

**Clast:** A fragment of rock.

**Corrugations:** Refers to the undulations present in CSP and SSP culvert material. Corrugations provide surface roughness which increases over the width and depth of standard dimensions.

**CSP:** Corrugated steel pipe. Pipe diameter is comprised of a single sheet of material.

**Culvert Entrance:** The downstream end of a culvert through which fish enter to pass upstream.

**Culvert Exit:** The upstream end of a culvert through which a fish exit to pass upstream.

**Culvert Inlet:** The upstream end of a culvert through which stream flow enters.

**Culvert Outlet:** The downstream end of a culvert through which stream flow discharges.

**Culvert:** A specific type of stream crossing, used generally to convey water flow through the road prism base. Typically constructed of either steel, aluminum, plastic, or concrete. Shapes include circular, oval, squashed-pipe (flat floor), bottomless-arch, square, or rectangular (Figure IX-10).

**Debris:** Material distributed along and within a channel or its floodplain either by natural processes or human influences. Includes gravel, cobble, rubble and boulder-sized sediments, as well as trees and other organic accumulation scattered about by either natural processes or human influences.

**Degradation:** The removal of streambed materials caused by the erosional force of water flow that results in a lowering of the bed elevation throughout a reach (Opposite of *aggradation*.)

**Deposition:** The settlement of material onto the channel-bed surface or floodplain.

**Dewater:** To remove water from an area.

**Embedment:** The depth to which a culvert bottom is buried into the streambed. It is usually expressed as a percentage of the culvert height or diameter.

**Exceedance Flow:** n percent exceedance flow is the flow that is equaled or exceeded n percent of the time.

**Fish Passage:** The ability of both adult and juvenile fish to move both up and down stream.

**Fishway:** A structure for passing fish over vertical impediments. It may include special attraction devices, entrances, collection and transportation channels, a fish ladder, and exit.

***FishXing*:** A computer software program developed by the Six Rivers National Forest Watershed Interactions Team. *FishXing* models culvert hydraulics (including open-bottom structures) and compares the predicted values with data regarding swimming and leaping abilities and minimum water depth requirements for numerous fish species.

**Flood Frequency:** The frequency with which a flood of a given discharge has the probability of recurring. For example, a "100-year" frequency flood refers to a flood discharge of a magnitude likely to occur on the average of once every 100 years or, more properly, has a one-percent chance of being exceeded in any year. Although calculation of possible recurrence is often based on historical records, there is no guarantee that a "100-year" flood will occur at all within the 100- year period or that it will not recur several times.

**Flood Prone Zone:** Spatially, this area generally corresponds to the modern floodplain, but can also include river terraces subject to significant bank erosion. For delineation, see definition for floodplain.

**Floodplain:** The area adjacent to the stream constructed by the river in the present climate and inundated during periods of high flow.

**Flow Duration (or Annual Exceedance Flow):** A flow duration curve describes the natural flow characteristics of a stream by showing the percentage of time that a flow is equal to or greater than a given value during a specified period (annual, month, or migration period). Flow exceedance values are important for describing the flow conditions under which fish passage is required.

**Fork Length:** The length of a fish measured from the most anterior part of the head to the deepest point of the notch in the tail fin.

**Freshet:** A rapid, temporary rise in stream flow caused by snow melt or rain.

**Geomorphology:** The study of physical features associated with landscapes and their evolution. Includes factors such as; stream gradient, elevation, parent material, stream size, valley bottom width and others.

**Grade Stabilization or Grade Control:** Stabilization of the streambed surface elevation to protect against degradation. Grade stabilization usually consists of a natural or man-made hard point in the channel that holds a set elevation.

**Gradient Control Weirs:** Stabilizing weirs constructed in the streambed to prevent lowering of the channel bottom.

**Gradient:** The slope of a stream-channel bed or water surface, expressed as a percentage of the drop in elevation divided by the distance in which the drop is measured.

**Headcut:** The erosion of the channel bed, progressing in an upstream direction, creating an incised channel. Generally recognized as small, vertical drops or waterfalls, or abnormally over-steepened channel segments.

**Hydraulic Capacity:** The maximum amount of flow (in cfs) that a stream crossing can convey at 100 percent of inlet height.

**Hydraulic Controls:** Weirs constructed primarily of rocks or logs, in the channel below a culvert for the purpose of controlling water depth and water velocity within the crossing.

**Hydraulic Jump:** An abrupt transition in streamflow from shallow and fast (supercritical flow) to deep and slow (subcritical flow).

**Incised channel:** A stream channel that has deepened and narrowed, becoming disconnected from its floodplain.

**Incision:** The resulting change in channel cross section from the process of degradation.

**Inlet Invert:** Location at inlet, on the culvert floor where an elevation is measured to calculate culvert slope.

**Inlet:** Upstream entrance to a culvert.

**Invert:** Lowest point of the crossing.

**Maximum Average Water Velocity in Culvert:** The highest average water velocity for any cross-section along the length of the culvert, excluding the effects of water surface drawdown at the culvert outlet.

**Mitigation:** Actions taken to avoid or compensate for the impacts to habitat resulting from man's activities (WAC 220-110-050).

**Ordinary High Water Mark (OHW Mark):** The mark along the bank or shore up to which the presence and action of the water are common and usual, and so long continued in all ordinary years, as to leave a natural line impressed on the bank or shore and indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics.

**Outlet Invert:** Location at outlet, on the culvert floor, where an elevation is measured to calculate culvert slope.

**Outlet:** Downstream opening of a culvert.

**Passage Flow:** Migration flows.

**Peak Flow:** One-hundred year flow event.

**Perched Outlet:** A condition in which a culvert outlet is suspended over the immediate downstream pool, requiring a migrating fish to leap into culvert.

**Pipe-arch:** A type of culvert with a flat floor and rounded sides and top, usually created by shaping or squashing a circular CSP or SSP pipe.

**Q<sub>hp</sub>:** Stream discharge (in cfs) at high passage flow. For adult salmonids, in California defined as the 1 percent exceedance flow (the flow equaled or exceeded 1 percent of the time) during the period of expected migration.

**Q<sub>lp</sub>:** Stream discharge (in cfs) at low passage flow. For adult salmonids, in California defined as the 90 percent exceedance flow for the migration period.

**Reach:** A section of a stream having similar physical and biological characteristics.

**Recurrence Interval:** Also referred to as flood frequency, or return period. It is the average time interval between actual occurrences of a hydrological event of a given or greater magnitude. A flood event with a two-year recurrence interval has a 50 percent chance of occurring in any given year.

**Regrade:** The channel's process of stabilization usually caused by new or extreme conditions. See headcut and degradation.

**Riffle Crest:** See "tailwater control".

**Riffle:** A reach of stream in which the water flow is rapid and usually more shallow than the reaches above and below. Natural streams often consist of a succession of pools and riffles.

**Riparian Area:** The area adjacent to flowing water (e.g., rivers, perennial or intermittent streams, seeps, or springs) that contains elements of both aquatic and terrestrial ecosystems, which mutually influence each other.

**Riprap:** Large, durable materials (usually fractured rocks; sometimes broken concrete, etc.) used to protect a stream bank or lake shore from erosion; also refers to the materials used for this purpose.

**Rise:** The maximum, vertical, open dimension of a culvert; equal to the diameter in a round culvert and the height in a rectangular culvert.

**Roads:** For purposes of these guidelines, roads include all sites of intentional surface disturbance for the purpose of vehicular or rail traffic and equipment use, including all surfaced and unsurfaced roads, temporary roads, closed and inoperable roads, legacy roads, skid trails, tractor roads, layouts, landings, turnouts, seasonal roads, fire lines, and staging areas.

**Salmonids:** A taxonomic group of fish that includes salmon and steelhead trout, among others.

**Scour:** The process of removing material from the bed or banks of a channel through the erosive action of flowing water.

**Section 10 and 404 Regulatory Programs:** The principal federal regulatory programs, carried out by the US Army Corps of Engineers, affecting structures and other work below mean high water. The Corps, under Section 10 of the River and Harbor Act of 1899, regulates structures in, or affecting, navigable waters of the US as well as excavation or deposition of materials (e.g., dredging or filling) in navigable waters. Under Section 404 of the Federal Water Pollution Control Act Amendments (Clean Water Act of 1977), the Corps is also responsible for evaluating application for Department of the Army permits for any activities that involve the placement of dredged or fill material into waters of the United States, including adjacent wetlands.

**Shear Strength:** The characteristic of soil, rock and root structure that resists the sliding of one material against another.

**Shear Stress:** A measure of the erosive force acting on and parallel to the flow of water. It is expressed as force per unit area (lb/ft<sup>2</sup>). In a channel, shear stress is created by water flowing parallel to the boundaries of the channel; bank shear is a combined function of the flow magnitude and duration, as well as the shape of the bend and channel cross section.

**Slope Ratio:** The ratio of the proposed culvert bed slope to the upstream water-surface slope.

**Slope:** Vertical change with respect to horizontal distance within the channel (*see gradient*). Refer to Appendix H for information on how to measure slope.

**Stream Crossing:** Any human-made structure generally used for transportation purposes that crosses over or through a stream channel including a paved road, unpaved road, railroad track,

biking or hiking trail, golf-cart path, or low-water ford. A stream crossing encompasses the structure employed to pass stream flow as well as associated fill material within the crossing prism.

**Substrate:** Mineral and organic material that forms the bed of a stream.

**Supercritical Flow:** Fast and shallow flowing water that is usually associated with a hydraulically steep, smooth surface.

**Tailout:** The downstream end of a pool where the bed surface gradually rises and the water depth increases. It may vary in length, but usually occurs immediately upstream of a riffle.

**Tailwater Control:** The channel feature which influences the water surface elevation immediately downstream of the culvert outlet. The location controlling the tailwater elevation is often located at the riffle crest immediately below the outlet pool. Tailwater control is also the channel elevation that determines residual pool depth.

**Thalweg:** The line connecting the lowest or deepest points along a streambed.

**Toe:** The base area of a streambank, usually consisting of the bottom margin of vegetated bank and that portion of bank that is submerged during low flow.

**Waters of the United States:** Currently defined by regulation to include all navigable and interstate waters, their tributaries and adjacent wetlands, as well as isolated wetlands and lakes and intermittent streams.

**Weir:** a) A notch or depression in a levee, dam, embankment, or other barrier across or bordering a stream, through which the flow of water is measured or regulated; b) A barrier constructed across a stream to divert fish into a trap; c) A dam (usually small) in a stream to raise the water level or divert its flow.

**Width Ratio:** The ratio of the proposed culvert-bed width to the upstream channel bankfull width.